advancedtelevisionsystemscommitteeinc

ATSC-Mobile DTV Standard, Part 5 – Application Framework

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The Advanced Television Systems Committee, Inc., is an international, non-profit organization developing voluntary standards for digital television. The ATSC member organizations represent the broadcast, broadcast equipment, motion picture, consumer electronics, computer, cable, satellite, and semiconductor industries.

Specifically, ATSC is working to coordinate television standards among different communications media focusing on digital television, interactive systems, and broadband multimedia communications. ATSC is also developing digital television implementation strategies and presenting educational seminars on the ATSC standards.

ATSC was formed in 1982 by the member organizations of the Joint Committee on InterSociety Coordination (JCIC): the Electronic Industries Association (EIA), the Institute of Electrical and Electronic Engineers (IEEE), the National Association of Broadcasters (NAB), the National Cable Telecommunications Association (NCTA), and the Society of Motion Picture and Television Engineers (SMPTE). Currently, there are approximately 140 members representing the broadcast, broadcast equipment, motion picture, consumer electronics, computer, cable, satellite, and semiconductor industries.

ATSC Digital TV Standards include digital high definition television (HDTV), standard definition television (SDTV), data broadcasting, multichannel surround-sound audio, and satellite direct-to-home broadcasting. Contact information is given below.

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A/153 Revision History

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1 SCOPE

The normative portions of this Part specify the interactive Application Framework in ATSC Mobile DTV (mobile/handheld, or simply M/H) services, which includes: layout of the service, transitions between layouts, composition of audio-visual components with auxiliary data components, sender controlled management of remote events and presentation timeline, coherent rendering of service and its layout over variety of device classes and platforms, rendering of action buttons and input fields, and event handling and scripting associated with such buttons and fields.

1.1 Introduction and Background

When the interactive Application Framework is included, an ATSC-M/H service consists of:

- One video component, one or more audio components, and zero or one interactive components; or
- One or more audio components, and zero or one interactive components; or
- One interactive component.

Applying this interactive application framework, the broadcaster, service provider, or content provider is able to create and control the presentation aspects of the service.

Since the interaction channel is optional, connection back from the receiving device to the sender is not always available.

This Part builds upon and makes direct references to functionality specified in the Open Mobile Alliance (OMA), World Wide Web Consortium (W3C), and Third Generation Partnership Project (3GPP) specifications for various aspects of encoding and delivering rich media environment (see references [1], [4], and [5]). Elements of those specifications that are not normatively referenced in this document are not part of this standard. For some of those elements referenced, this Part provides guidance for authors of Application Framework aspects.

1.2 Organization

This document is organized as follows:

- **Section 1** – Outlines the scope of this Part and provides a general introduction.
- **Section 2** – Lists references and applicable documents.
- **Section 3** – Provides a definition of terms, acronyms, and abbreviations for this Part.
- **Section 4** – System overview (informative)
- **Section 5** – Presents a deployment overview of how this Application Framework specification can be applied together with the basic ATSH-M/H service.
- **Section 6** – Specifies normative and informative aspects for the restrictions in Application Framework in ATSC-M/H services. This section frequently refers to the applied specifications [1], [4], and [5] without repeating their content in this document.

- • **Section 7** – Signaling and announcement.
- • **Section 8** – Provides an informative guideline for authors creating, transmitting, and managing Application Framework. This section gives authoring guidelines to ensure that authors of ATSC-M/H Application Framework follow same constrains and principles, and that the ATSC-M/H Application Framework is widely received and rendered in fully coherent fashion.
- • **Section 9** – Provides an informative guideline for the Application Framework User Agent implementers on areas that may require clarification when implemented on ATSC-M/H client devices.
- • **Section 10** – ECMASCRIPT code samples.

2 REFERENCES

At the time of publication, the editions indicated below were valid. All standards are subject to revision, and parties to agreement based on this standard are encouraged to investigate the possibility of applying the most recent editions of the documents listed below.

2.1 Normative References

The following documents contain provisions which, through reference in this text, constitute provisions of this standard.

[1] OMA: "Rich Media Environment, Candidate Version 1.0 – 14 Oct 2008," Doc. OMA-TS-RME-V1_0-20081014-COpen Mobile Alliance, San Diego, CA, 14 Oct 2008.

[2] IEEE/ASTM SI 10-2002, "Use of the International Systems of Units (SI): The Modern Metric System", Institute of Electrical and Electronics Engineers, New York, N.Y.

[3] AES: "AES standard on network and file transfer of audio - Audio-file transfer and exchange - File format for transferring digital audio data between systems of different type and manufacture," Doc. AES31-2-2006, Audio Engineering Society, Inc. New York, NY, 15 July 2006.

2.2 Informative References

[4] 3GPP: "Dynamic Interactive Multimedia Scenes (DIMS), version 7.1.0", Doc. 3GPP TS 26.142 version 7.1.0 release 7, 3rd Generation Partnership Project, Sophia-Antipolis Cedex, France, October 2007.

[5] W3c: "Scalable Vector Graphics (SVG) Tiny 1.2 Specification," World Wide Web Consortium, Sophia-Antipolis Cedex, France, 10 August 2006.

[6] OMA: "ECMAScript Mobile Profile, Candidate Version 1.0," Doc. OMA-WAP-ESMP-V1_0-20061020-A, Open Mobile Alliance, San Diego, CA, 20 October 2006.

[7] ATSC: "ATSC Digital Television Standard, Part 2 – RF/Transmission System Characteristics," Doc. A/53 Part 2:2007, Advanced Television Systems Committee, Washington, D.C., 3 January 2007.

[8] ATSC: "ATSC Mobile/Handheld Digital Television Standard, Part 1 – Mobile/Handheld Digital Television System," Doc. A/153 Part 1:2009, Advanced Television Systems Committee, Washington, D.C., 15 October 2009.

[9]   ATSC: "ATSC Mobile/Handheld Digital Television Standard, Part 3 – Service Multiplex and Transport Subsystem Characteristics," Doc. A/153 Part 3:2009, Advanced Television Systems Committee, Washington, D.C., 15 October 2009.

[10]   ATSC: "ATSC Mobile/Handheld Digital Television Standard, Part 4 – Announcement," Doc. A/153 Part 4:2009, Advanced Television Systems Committee, Washington, D.C., 15 October 2009.

[11]   ISO/IEC: "Information technology – Coding of audio-visual objects – Part 20: Lightweight Application Scene Representation (LASeR) and Simple Aggregation Format (SAF)," Doc. ISO/IEC 14496-20:2006(E), International Standards Organization, Geneva, Switzerland, 15 June 2006.

[12]   OMA: "Architecture of the Mobile Broadcast Services Candidate Version 1.0 – 9 June 2008," Doc. OMA-AD-BCAST-V1_0-20080609-C, Open Mobile Alliance, San Diego, CA, 9 June 2008.

[13]   OMA: "Mobile Broadcast Services Requirements Candidate Version 1.0 – 26 Feb 2008," Doc. OMA-RD-BCAST-V1_0-20080226-C Open Mobile Alliance, San Diego, CA, 26 February 2008.

[14]   OMA: "Rich Media Environment Architecture Draft Version 1.0 – 15 June 2007," Doc. OMA-AD-Rich_Media_Environment-V1_0-20070615-D, Open Mobile Alliance, San Diego, CA, 15 June 2007.

[15]   OMA: "Rich-Media Environment Requirements Candidate Version 1.0 – 23 Sept 2005," Doc. OMA-RD-Rich-Media-Environment-V1_0-20050923-C, Open Mobile Alliance, San Diego, CA, 23 September 2005.

3   DEFINITION OF TERMS

With respect to definition of terms, abbreviations, and units, the practice of the Institute of Electrical and Electronics Engineers (IEEE) as outlined in the Institute's published standards shall be used [2]. Where an abbreviation is not covered by IEEE practice or industry practice differs from IEEE practice, the abbreviation in question will be described in Section 3.3 of this document.

3.1   Compliance Notation

As used in this document, "shall" denotes a mandatory provision of the standard. "Should" denotes a provision that is recommended but not mandatory. "May" denotes a feature whose presence does not preclude compliance, which may or may not be present at the option of the implementer.

3.2   Treatment of Syntactic Elements

This document contains symbolic references to syntactic elements used in the audio, video, and transport coding subsystems. These references are typographically distinguished by the use of a different font (e.g., restricted), may contain the underscore character (e.g., sequence_end_code) and may consist of character strings that are not English words (e.g., dynrng).

3.2.1   Reserved Fields

reserved — Fields in this document marked "reserved" are not to be assigned by the user, but are available for future use. Receiving devices are expected to disregard reserved fields for which no definition exists that is known to that unit. Each bit in the fields marked "reserved" is to be set to '1' until such time as it is defined and supported.

3.3   Acronyms and Abbreviation

The following acronyms and abbreviations are used within this specification.

ATSC – Advanced Television Systems Committee

AES – Audio Engineering Society

DIMS – Dynamic Interactive Multimedia Scenes

LASeR – Lightweight Application Scene Representation

MPEG– Moving Picture Experts Group

OMA – Open Mobile Alliance

RME – Rich Media Environment

SDP – Session Description Protocol

SVG – Scalable Vector Graphics

W3C – World Wide Web Consortium

3.4   Terms

The following terms are used within this specification.

Canvas – The on-screen area in which OMA-RME user experience elements can be placed. Typically the canvas size will match that of the video layer.

Primary DIMS Stream – A stream which defines the complete scene tree; i.e., in which all random access points are, or build, a complete DIMS Scene.

Principal Broadcast Stream – The principal broadcast service is the current broadcast audio/ video service being presented by the primary video and audio decoder.

Secondary DIMS Stream – A stream that manages only a portion of the scene tree.

SVG Global data structure – A data structure defined in the SVG Tiny 1.2 [5] language which defines structures and methods that are globally available.

WAVE - (also **WAV** or **.wav**) File format for storing an audio bitstream, used as de facto standard for audio storage on PCs. Based on Resource Interchange File Format (RIFF), a generic meta-format for storing data in tagged "chunks".

4   SYSTEM OVERVIEW (INFORMATIVE)

The ATSC Mobile/Handheld service (M/H) shares the same RF channel as a standard ATSC broadcast service described in ATSC A/53 [7]. M/H is enabled by using a portion of the total available 19.4 Mbps bandwidth and utilizing delivery over IP transport. A basic block diagram
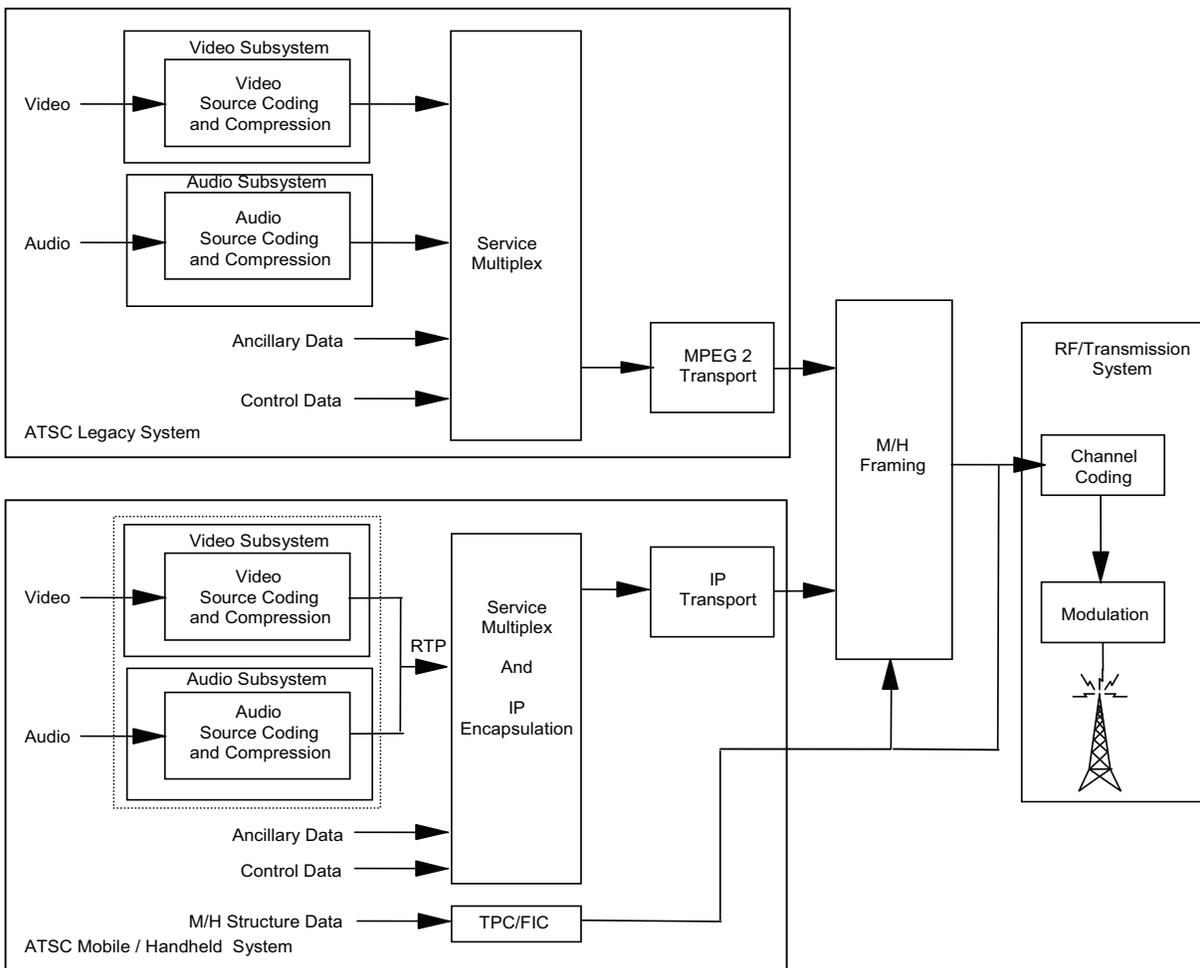
Figure 4.1 ATSC M/H block diagram.

representation of the overall system is shown in Figure 4.1. Please see ATSC A/153 Part 1 [8] for more information.

4.1 Application Framework Overview

The primary objective for the ATSC-M/H platform is to deliver a set of audio and/or video services from a transmission site to mobile or portable devices. The Application Framework for ATSC-M/H enables the broadcaster of the audio-visual service to author supplemental content to define and control various additional elements to be used in conjunction with the ATSC-M/H audio-visual service. It enables one to define auxiliary (graphical) components, layout for the service, transitions between layouts and composition of audio-visual components with auxiliary data components. Furthermore, it enables the broadcaster to send remote events to modify the presentation and to control presentation timeline. The Application Framework as specified in this Part further enables coherent rendering of the service and its layout over a variety of device classes and platforms, rendering of action buttons and input fields, and event handling and scripting associated with such buttons and fields.

Figure 4.2 – Application Framework along with basic ATSC-M/H audio+video service.

The Application Framework adds additional signaling and data content to the basic ATSC-M/H audio-visual service. Figure 4.2 illustrates the results of an Application Framework when provided along with basic ATSC-M/H service.

The Application framework consists of the following OMA RME components:
- Format of scene descriptions
- Scene commands
- Inline scripting
- Event handling
- Timing and processing model
- Packaging and delivery
- Static and dynamic device capabilities

Scene descriptions are the visual components that when combined form a look and feel beyond the broadcast audio/video.

Scene commands are the data that manipulate the creation, appearance, disappearance, and destruction of scenes.

Scripting allows for the manipulation of variables within scenes enabling such functionality as visual element changes and networked data transmission/retrieval.

Events can be delivered via the user interface, the broadcast channel or timers within the scenes.

Static capabilities are scene information used via files which can be either pre-populated on the client or transmitted as files in the broadcast. Dynamic Received Capabilities are transmitted in real-time through the broadcast.

5   OMA RICH MEDIA ENVIRONMENT FOR ATSC-M/H

5.1   OMA RME Introduction (Informative)

This Part defines a Application Framework for ATSC-M/H content based upon OMA Rich Media Environment [1]. The OMA RME in turn builds on W3C SVG Tiny 1.2 [5], 3GPP Dynamic Interactive Multimedia Scenes [4], and the Mobile Profile of ECMAscript [6] a rich scripting language. (which are normative provisions of [1]).

5.2   OMA RME for ATSC-M/H

Any functionality in the following sections that would require mandatory access to interactive return channel from the received back to the sender shall be considered optional to provide and to support.

   The Application Framework shall be comprised of all of the following components from the OME RME specification [1], as further constrained below in Section 6:

- Format of scene descriptions together with associated rendering and handling of device-local UI events according to OMA RME [1], Section 6.
- Scene commands to introduce, update, activate, and manage scenes according to OMA RME [1], Section 7.
- Scripting according to OMA RME [1], Section 8.
- Event handling according to OME RME [1], Section 9.
- Timing and processing model according to OMA RME [1], Section 10.
- Packaging and delivering the scene descriptions and scene commands as data streams according to OME RME [1], Section 11.
- Static and dynamic device capabilities according to OME RME[1], Section 12.

6   EXTENSIONS AND CONSTRAINTS ON OMA RME

The ATSC-M/H Application Framework extends and constrains some OMA-RME [1] components as follows. These additions and constraints are mandatory to insure an M/H compliant OMA-RME datastream.

6.1   Delivery of OMA-RME Data

The RME data shall be packaged, accessed and delivered as streamed sequences of RME Units defined in Section 11.4 in [1].

6.2   Use of 'video' Element

6.2.1   Handling of Primary Broadcast Service

The 'video' element of SVG shall not be used for managing the principal broadcast service. Instead, non-transparent portions of the SVG content are at higher level of the visual stack and shall occult video content from the principal broadcast service on the display screen as an overlay thereof.

6.3   Use of 'audio' Element

The 'audio' element of SVG shall be mixed by the receiver with the audio from the primary broadcast service. One format for audio elements is currently defined. This format for audio

elements shall be uncompressed PCM samples wrapped in the WAVE File Format as defined in [3]. PCM samples shall be 16 bit mono (1 channel) at a sampling rate of 8,000 or 16,000 samples per second.

6.4 Use of 'image' Element

Two formats for graphic elements are currently defined. Support for the 'image' element of SVG in [5] is specified for the following image file formats:

- image/jpeg
- image/png

6.5 ATSCGlobal Interface

The ATSCGlobal Interface shall be constructed as shown in Table 6.1 and shall be a part of the SVG Global interface. This interface contains ATSC-M/H specific functions focusing on multimedia and shall be as defined in Table 6.1. The ATSCGlobal interface shall be defined immediately following exiting definitions in SVG Global.

Table 6.1 ATSCGlobal IDL specification

IDL Definition

interface ATSCGlobal : Global
 	
    {
 	
        void tune(in DOMString sdpData);
 	
    };
 	
No defined constants
 	
No defined attributes
 	
Methods
 	
    Tune
 	
        Tune to the specified SDP File text on the current TSID and Ensemble.
 	
    Parameters:
 	
        sdpData The text of an SDP file for tuning. See Annex B for example.

6.5.1 Managing the Primary Broadcast Service

The author of OMA-RME application in ATSC-M/H may desire to change the source of the primary broadcast service that is playing underneath the OMA-RME layer. The tune() function of the ATSCGlobal Interface allows the OMA-RME author to change the primary broadcast service to an SDP file. This will not allow the OMA-RME author to re-tune the frequency or ensemble of the tuner, but only the IP Multicast source being viewed.

6.6 Obtaining Client Information

The author of the OMA-RME application may desire to retrieve the physical location and user information of the client device. The getATSCUserLocation() function inside the ATSCUsage binding returns an ATSCCoordinates structure with the current latitude, longitude and altitude. The functions getATSCUserName(), getATSCUserEmail(), and getATSCUserAge() are also supported.

6.6.1   ATSCUsage Binding

The ATSCUsage Interface shall be part of the SVG Global interface. This interface contains ATSC-M/H specific functions focusing on usage information and shall be as defined in Table 6.2. The interface shall be added after the ATSCGlobal definition.

Table 6.2 ATSCUsage IDL specification

IDL Definition
interface ATSCUsage: Global
{
ATSCCoordinates getATSCUserLocation(in unsigned long timeout);
DOMString getATSCUserName();
DOMString getATSCUserEmail();
unsigned short getATSCUserAge();
};
No defined attributes
No defined constants
getATSCUserLocation
Retrieve the current location.
Parameters
timeout: Try to determine a location for timeout milliseconds before failing and filling in the ATSCCoordinates structure with values of 0.0.
Returns
Returns an ATSCCoordinates structure.
getATSCUserName
Retrieve the name stored in the OMA-RME User Agent.
Parameters
None

Table 6.2 ATSCUsage IDL specification

Returns
Returns a DOMString of the users' name
getATSCUserEmail
Retrieve the email address stored in the OMA-RME User Agent.
Parameters
None
Returns
Returns a DOMString of the users' email address
getATSCUserAge
Retrieve the age stored in the OMA-RME User Agent.
Parameters
None
Returns
Returns an unsigned short integer of the users' age in years

6.6.2   ATSCCoordinates Binding

The ATSCCoordinates Interface shall be part of the SVG Global interface. This interface contains elements to retrieve location information, and shall be as defined in Table 6.3.

Table 6.3 ATSCCoordinates IDl specification

IDL Definition

    interface ATSCCoordinates

        {

                attribute float latitude;

                attribute float longitude;

                attribute float altitude;

        };

No defined attributes

No defined constants

Defined elements

latitude – floating point value of latitude in units of positive degrees referred to North using the WGS84 Datum

longitude – floating point value of latitude in units of positive degrees referred to East using the WGS84 Datum

altitude – floating point value of altitude in units of positive meters using the WGS84 Datum

---

6.7 SVG Canvas

The SVG Canvas is considered to be the area in which graphical and other informative elements can be rendered.

6.7.1 SVG Canvas Size

The SVG canvas size shall match the size of the principal broadcast service. If no principal broadcast service is present, any SVG canvas size may be used. In the case of Scalable Video Coding the OMA-RME canvas shall match the size of the video base layer.

6.7.2 SVG Canvas Scaling

The SVG Canvas and all elements it contains shall scale proportionally with the scaling of the video region of the primary broadcast service. That is if the video region is scaled by a factor of N to a larger or smaller resolution then all visual elements are also scaled by N. In the case of Scalable Video Coding the OMA-RME canvas shall match the size of the video base layer and then the canvas and all elements shall be scaled to match the size of the enhancement layer if used.

6.8 SVG Global Module Changes

The Global module IDL definition as defined in SVG Tiny 1.2 Appendix B [5] shall be as shown in Table 6.4. The ATSC additions are shown in ***bold italics***.

Table 6.4 SVG Tiny Global Module IDL extensions

```
module global
{
     typedef dom::DOMString DOMString;
     typedef dom::DOMException DOMException;
     typedef events::EventTarget EventTarget;
     interface Connection;
     interface Timer;
     interface ATSCGlobal;
     interface ATSCCoordinates;
     interface ATSCUsage;

     interface Global
     {
     };

     exception GlobalException
     {
          unsigned short code;
     };

     const unsigned short NOT_CONNECTED_ERR = 1;
     const unsigned short ENCODING_ERR = 2;
     const unsigned short DENIED_ERR = 3;
     const unsigned short UNKNOWN_ERR = 4;

     interface Connection : EventTarget
     {
          readonly attribute boolean connected;
          void connect(in DOMString host, in unsigned short port)
               raises(GlobalException);
          void send(in sequence<octet> data)
               raises(GlobalException);
          void close();
     };

     interface Timer : events::EventTarget
     {
          attribute long delay;
```

Table 6.4 SVG Tiny Global Module IDL extensions

```
        attribute long repeatInterval;
        readonly attribute boolean running;
        void start();
        void stop();
    };


    interface ATSCGlobal : Global

    {

        void tune(in DOMString sdpData);

    };


    interface ATSCCoordinates

    {

        attribute float latitude;

        attribute float longitude;

        attribute float altitude;

    };


    interface ATSCUsage: Global

    {

        ATSCCoordinates getATSCUserLocation( in unsigned short timeout );

        DOMString getIATSCUserName();

        DOMString getATSCUserEmail();

        unsigned short getATSCUserAge();

    };
```

6.9 DIMS SDP Parameters

The formatting of SDP parameters to signal DIMS streams shall be constructed as shown in Section 7.3.3 of [4]. The Version-profile shall be 10 and Level shall be 10. Differing from Section 7.3.3 of [4], the DIMS RTP timestamp field shall use a 90,000 Hz frequency. Note: this is the same as the RTP timestamp frequency for video.

7   SIGNALING AND ANNOUNCEMENT (INFORMATIVE)

Signaling of current services ATSC M/H Application Frameworks is defined in ATSC A/153 Part 3 [9].

Announcement in the ATSC M/H Service Guide is defined in ATSC A/153 Part 4 [10].

8   AUTHORING GUIDELINES (INFORMATIVE)

This section gives guidelines for the authors of Application Framework components including the scenes, the content layout and the extent to which authors can expect the receiving devices be able

to render and interpret the Application Framework. These guidelines are provided for authors to develop Application Framework components that are consistent in terms of possible required receiver capabilities.

8.1 Transition Points

At the point of transition where an author wants to start with an empty SVG uDOM [5], a 'new scene' command should be issued.

9   USER AGENT GUIDELINES (INFORMATIVE)

This section gives guidelines for the implementers of OMA RME User Agents (receivers) in ATSC-M/H context.

9.1 Clear Canvas

The receiver should interpret a clear canvas as one which all pixels are fully transparent and the display of the primary video service is not obstructed in any manner.

10 ECMASCRIPT CODE SAMPLES (INFORMATIVE)

Sample ECMAscript code for ATSCGlobal.tune() assuming IP Multicast on current TSID and Ensemble is shown in Table 10.1.

Table 10.1 ECMAScript code example 1

```
var sdpData = "v=0\n";

sdpData += "o=QTSS_Play_List 2523221220 1565862723 IN IP4 172.16.131.82\n";

sdpData += "s=ch2\n";

sdpData += "c=IN IP4 225.0.0.2\n";

sdpData += "b=AS:812\n";

sdpData += "t=0 0\n";

sdpData += "a=x-broadcastcontrol:TIME\n";

sdpData += "a=control:*\n";

sdpData += "m=video 9000 RTP/AVP 35\n";

sdpData += "b=AS:785\n";

sdpData += "a=rtpmap:35 H264/90000\n";

sdpData += "a=control:trackID=1\n";

sdpData += "a=cliprect:0,0,240,416\n";

sdpData += "a=fmtp:35 packetization-mode=1;profile-level-id=42E00D;sprop-parameter-sets=Z0LADZZ0Cg/
YAgQAADhAAAr8gtGAPSAJK3vfB4RCNQ==,aN48gA==\n";

sdpData += "m=audio 9002 RTP/AVP 37\n";

sdpData += "b=AS:27\n";

sdpData += "a=rtpmap:37 mpeg4-generic/48000/2\n";

sdpData += "a=control:trackID=2\n";

sdpData += " a=fmtp:37 streamType=5; profile-level-id=48; mode=AAC-hbr; config=EB098800 sizeLength=13;
indexLength=3; indexDeltaLength=3; constantDuration=2048\n";

sdpData += "m=video 9004 RTP/AVP 41\n";
```

Table 10.1 ECMAScript code example 1

```
sdpData += "a=rtpmap:41 richmedia+xml/90000\n";

sdpData +="a=fmtp:41 Version-profile=10; Level=10")"\n
tune(sdpData );
```

Sample ECMAscript code for ATSCLocation.getATSCUserLocation() is shown in Table 10.2.
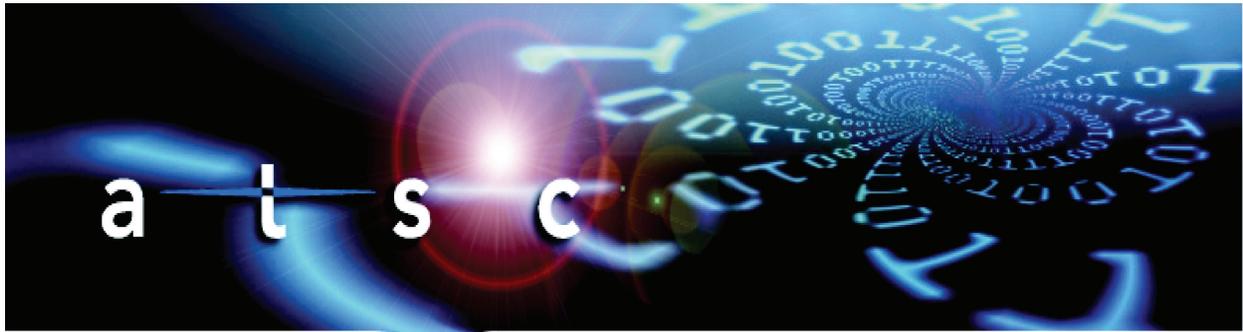
Table 10.2 ECMAScript code example 2

```
var timeout = 30000; // 30 seconds timeout

var location = getATSCUserLocation( timeout );

alert( "Latitude: " + location.latitude + "\nLongitude: " +

    location.longitude + "\nAltitude: " + location.altitude );
```

Sample ECMAscript code for ATSCUsage.getName(), ATSCUsage.getEmail(), and ATSCUsage.getAge() is shown in Table 10.3.

Table 10.3 ECMAScript code example 2

```
var name = getATSCUserName();

var email = getATSCUserEmail();

var age = getATSCUserAge();


alert( "Name: " + name + "\nEmail: " + email + "\nAge in years: " + age );
```